INDUSTRY REVIEW

Beef Bone Disposition Australia 2024

V.RMH.2402: Program evaluation and prototype development

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Bone volumes

Beef bone material is removed in two primary stages. These include:

- **Slaughter floor:** Bones removed at this stage include the head, feet, and tail.
- **Boning room:** Bones are removed to prepare boneless meat cuts for sale. These bones typically include ribs, leg bones, scapula, and vertebrae.

The MLA Protein Calculation Spreadsheet Tool, developed by Bill Spooncer, provides information on the weights of slaughter floor and boning room bone for different carcase weights (**Table 1**).

Table 1 Beef carcase bone recovery (kgs)

	Carcase weight	Feet	Tail	Head	Slaughter floor hard	Boning room bone	Total bone
Vealer 70–110kg	100	4.77	0.36	5.16	10.29	28.00	38.29
Yearling 110–220kg	180	6.50	0.74	7.64	14.88	36.00	50.88
Steer 220–340kg	275	8.13	0.93	11.60	20.66	52.25	72.91
Steer grain fed 300–400kg	380	8.06	1.30	11.54	20.90	64.60	85.50
Cow 150–300kg	200	7.45	0.73	9.12	17.30	40.00	57.30
Bull 220–420kg	300	10.10	1.00	14.05	25.15	60.00	85.15

When assessing the potential disposition of bones removed from the carcase, it is generally the bones recovered from the boning room that are sought by other parties. Rendering processes also require a minimum amount of hard material to maintain ease of operation and flowability of the material being rendered. The slaughter floor hard material, such as head, feet and tails, typically provide this necessary hard material. Therefore, when evaluating options for beef bone, the scope can be limited to bones recovered from the boning room.

In *Australian Cattle Industry Projections: September 2024 Update,* Meat & Livestock Australia (2024) reports that in 2024, carcase weights would fall 1.4% to 309.5kg largely due to the increase in female slaughter as a proportion of total adult slaughter. In 2025, carcase weights will continue to fall to 304.7kg, before beginning to rise in 2026 to 305.1kg – back in line with the five-year average.

For this report, an average carcase weight of 305kg is used, resulting in a boning room bone yield of 61kg/carcase.

The National Livestock and Reporting service reported a national cattle slaughter of 5.9 million head for the calendar year 2023. Queensland accounted for 52% of the slaughter at 3 million, followed by NSW for 26% at 1.5 million. The *Australian Cattle Industry Projections: September 2024 Update* also forecasts a 16% increase to 8.2 million head.

Considering the slaughter data for 2023 and an average carcase weight of 305kg with 61kg boning room material, the potential bone volume over that period can be determined (**Table 2**).

Table 2 Annual slaughter and bone volumes by state (2023)

State	Slaughter head	%	Bone t
NSW	1,537,756	0.26	93,803
QLD	3,035,723	0.52	185,179
SA	165,422	0.03	10,091
TAS	227,573	0.04	13,882
VIC	746,897	0.13	45,561
WA	145,901	0.02	8,900
Australia	**5,859,272**		**357,416**

Current disposition of bones

Most bones recovered from the boning room are sent to rendering and are processed with slaughter floor co-products. Only two other commercial dispositions are known, which include:

1. processing into degreased bone chips for gelatine manufacture
2. sale of leg bones as a feed for bone marrow extract.

Degreased bone chip

Fresh bones are crushed and degreased in hot water. Fat and muscle released to the hot water is then separated in a decanter with the solids being dried and the fat recovered as tallow in centrifuges. The solid phase, containing the degreased bone chips, is dried in a rotary drum drier. After drying, gravity separators are used to separate any remaining meat and sinew from the bone.

The degreased bone chips can then be sold as a raw material for gelatine and dicalcium phosphate (DCP) manufacture, while the recovered dried meat and sinews are sold as a high protein meal, and the tallow is sold as an edible formula. Both the meal and tallow can be classified as viscera free.

For use in gelatine, the bone chip must first be demineralised by soaking in hydrochloric acid solution. For every 1t of degreased bone chip 500kg of DCP is recovered, capturing a further valuable resource from the bone.

Two separate processors have integrated bone chip degreasing plants into their boning rooms. Prior to the bovine spongiform encephalopathy (BSE) crisis and the resultant requirement to remove the vertebra, two additional processors were also processing degreased bone chips. However, the *Terrestrial Animal Health Code* no longer requires elimination of the vertebra, or other specified risk materials (SRM) from gelatine raw materials.

Change of ownership and consolidation of abattoirs and by-products plants has also lowered the priority of gel bone production, with some owners preferring to concentrate on the efficiency of the Meat and Bone Meal (MBM) plants.

The estimated combined slaughter volume for the two plants recovering gel bone is approximately 950,000 head/year, giving an annual processed bone volume of around 60,000t of fresh bone.

Bone marrow extract

In Australia, one gel bone plant is known to be producing beef bone extract and one manufacturing plant is known to be purchasing leg bones for beef leg bone extract.

Needham and Rankin (2018) note in *V.RMH.0074 Review of meat bone by-product processing platform and high-value opportunities and trends* that the most significant challenge facing manufacturers has been gaining access to a secure supply of bones. Local meat processors do not have adequate freezer facilities to store the bones, so prefer to process bones on-site through the rendering plant.

The ability to sell leg bones for marrow extraction is limited by freezer capacity which is insufficient to freeze and sell all marrow bones. This means supply can be sporadic and dependent on freezer space and the sale of other frozen co-products.

It is estimated that the weight of tibia and femur bones is approximately 6kg/305kg carcase, or 10% of the boning room bone.

The actual bone supply volume for beef bone extract is not known but is estimated to be approximately 1000t of fresh bone/year.

Table 3 Disposition of beef bones in Australia (2023)

Bone disposition	Bone t	%
Bones to rendering	297,397	83.2
Bones to gel Bone	58,804	16.5
Bones to bone extract	1,215	0.3
Total bones	**357,416**	

Revenue comparison

The following comparisons are based on MLA's October 2024 pricing data for MBM50 at $597/t, ex works, and tallow at $1,420/t.

The MLA Protein Calculation Spreadsheet Tool predicts the protein, ash and fat content of rendering inputs, including bones, and the subsequent recovery of MBM and tallow from beef bones. This allows calculation of the value from rendering bones for every tonne of fresh bone/head.

Table 4 Margin for rendering bone

Rendering	
MBM50 from bone	26.84kg/head
Tallow from bone	13.42kg/head
Margin rendering/tonne of bone	$375.08/t
Margin rendering/head	**$22.88/head**

The margin, being the revenue from MBM and tallow, depicts the processing costs for rendering bones (**Table 4**).

Sale of bones for gel bone

Independent renderers determine a purchase price for input materials based on the return from MBM and tallow. Using the current October MBM and tallow pricing, this would equate to a purchase price for bones of approximately $345/t. To provide an incentive for a processor to divert fresh bones for gel bone, a premium of 15% is often used. This equates to a gel bone purchase price of approximately $397/t of fresh bones, while achieving a competitive degreased bone chip pricing of around $800–900/t of bone chip.

However, by diverting the high ash bone from rendering to gel bone, the processor also increases the protein content and reduces the ash content of the MBM. Using the MLA Protein Calculation Spreadsheet Tool, the properties of the resultant MBM can be predicted (**Table 6**).

Assuming the higher value of MBM protein to be 60% at $800/t, a greater margin can be expected from rendering with the bones removed, along with the increased margin from the sale of bones (**Table 7**).

Table 5 Improved processor margin of gel bone sales

Revenue sale fresh bones for gel bone	$397.00/t
Revenue sale fresh bones for gel bone	$24.22/head
Improved margin sale fresh bone vs rendering	$21.92/t
Improved margin sale fresh bone vs rendering	**$1.34/head**

Table 6 Impact of bone sale on MBM protein and ash

Sale of bone impact on MBM protein	**Protein%**	**Ash%**
MBM protein/ash with bone in	50%	32%
MBM protein/ash with bone excluded	**60%**	**20%**

Table 7 Impact of sale (MBM60)

Improved margin per head MBM60	$5.45/head
Combined improved margin sale bone + MBM60	$6.79/head

Sale of bones for bone extract

The improved margin of frozen marrow bones over rendering can be estimated (**Table 8**).

Table 8 Impact of sale of marrow bones

Estimated improved margin sale bones for bone extract	$600.00/t
Estimated improved margin sale bones for bone extract	$40.00/head

Potential national benefits

If all the leg bones were harvested and converted to leg bone extract with the remaining bones being degreased and sold as bone chip for gelatine manufacture, and the improved quality of MBM protein is 60%, the national benefit to processors as improved margins would reflect a economical gain of $58 million/year or $10/head.

References

Meat & Livestock Australia. (2024). *Australian Cattle Industry Projections: September 2024 Update*. https://www.mla.com.au/globalassets/mla-corporate/prices--markets/documents/trends--analysis/cattle-projections/september-2024-update_mla-australian-cattle-industry-projections_020924.pdf

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